

## Silurian Polyplacophora and Rostroconchia (Mollusca) from Northern California

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**Silicified polyplacophorans from the Gazelle Formation in California represent the second known Silurian (Ludlovian) occurrence of this class in North America. New taxa are *Paleochiton siskiyouensis* sp. nov. and *Thairoplax merriami* sp. nov. *Eusphairica distubula* gen. et sp. nov. is the first Silurian rostroconch identified in the United States and extends the range of the family Eopteriidae Miller, 1889, from the Middle Ordovician into the Upper Silurian.**

The late C. W. Merriam (1972), U. S. Geological Survey, collected and processed samples of limestone cobbles with silicified fossils from a conglomeratic zone of the Silurian Gazelle Formation exposed in Siskiyou County, California, in 1951, and noted the presence of amphineuran plates. Some of the specimens obtained were placed in the collections of the California Academy of Sciences. Peter U. Rodda brought this polyplacophoran fauna to my attention.

Preservation of the silicified plates range from poor to excellent. Many are incomplete and most have additional siliceous deposits adhering to them. All are intermediate plates with the exception of two tail plates. Head plates were not found among the more than 50 specimens.

A single specimen of a rostroconch is present with a portion of a chiton plate attached to it. The importance of this rostroconch occurrence necessitated the removal of as much of the plate and other adhering material as possible to allow better photographic representation of the specimen.

Based on the rugose coral fauna described by Merriam (1972), and the accompanying fauna of brachiopods, gastropods, and trilobites, the Gazelle Formation is mainly Late Silurian (Ludlovian) in age. Portions of the formation in this region may be slightly older or younger than this (Merriam 1972:23).

The collection locality in the Gazelle Formation, which represents the type locality for all of the new taxa herein, is 2 km southeast of Parker Ranch, East Fork of the Scott River, SW  $\frac{1}{4}$  sec. 29, T41N, R7W, Siskiyou County, California, Etna quadrangle, USGS locality M1027.

### PREVIOUS STUDIES

European Silurian polyplacophorans have been studied by Salter (in M'Coy 1846), de Koninck (1857; translated by Bailey 1860), Barrande (1867), Davidson and King (1874), Lindström (1884), Woodward (1885), Etheridge (1897), Couper Reed (1911), Bergenhayn (1943, 1955), and Cherns (1998a, 1998b, 1999).

Other than the noted presence by Merriam (1972:15), the only other account of North American Silurian polyplacophorans was by Kluessendorf (1987), from Wisconsin, Illinois, and Iowa. Collected from carbonate buildups, these specimens are preserved as impressions of the ventral surface.

Kluessendorf erected, *Chelodes raaschi* sp. nov. and *Hawthorneachiton lowenstami* gen. et. sp. nov. Other specimens were described as morphotypes. One of the latter, Morphotype H (Kluessendorf 1987, fig. 10), represents a turrelaped plate.

#### SPECIES DESCRIPTIONS

Class Polyplacophora de Blainville, 1816  
Subclass Paleoloricata Bergenhayn, 1955  
Order Chelodida Bergenhayn, 1955  
Suborder Chelodina Bergenhayn, 1955  
Family Gotlandochitonidae Bergenhayn, 1955  
Genus *Paleochiton* Smith in Smith and Toomey, 1964

#### *Paleochiton siskiyouensis* sp. nov.

Fig. 1

TYPE MATERIAL. — HOLOTYPE: CAS 68395, PARATYPES: CAS 68396.01–68396.18.

DIAGNOSIS. — Intermediate plates strongly arched; shallow to deep jugal sinus; apical area short, bordering nearly straight to slightly produced posterior margin.

DESCRIPTION. — Intermediate plates strongly arched, subrectangular in dorsal view; jugal area rounded; side slopes flatly convex; posterior margin straight to slightly mucronate; lateral margins straight to slightly convex, nearly parallel; anterior margin with deep jugal sinus; jugal angle 83°–89°; apical area short, 1.4 mm in length, straight to flatly V-shaped; shell material thick medially, thinning laterally; surface smooth.

Tail plate wedge-shaped in dorsal view; posterior margin pointed, curved dorsally; anterior margin flatly convex; jugal area broadly rounded, side slopes flat.

MEASUREMENTS. — See Table 1.

DISCUSSIONS. — *Paleochiton siskiyouensis* differs from the Ordovician *P. kindbladensis* Smith in Smith and Toomey, 1964, by having a larger length:width ratio 1.26:1.14, a smaller jugal angle 86°–114°, and smaller valve size. Kluessendorf's Morphotype A (1987:439, fig. 4, Pl. 1, fig. 3) may be a *Paleochiton* but has a larger jugal angle, 100°–120°, and is a larger plate. The anterior margin is unknown.

ETYMOLOGY. — Named for Siskiyou County, California.

Genus *Thairoplax* Cherns, 1998b

#### *Thairoplax merriami* sp. nov.

Figs. 2A–N

TYPE MATERIAL. — HOLOTYPE: CAS 68397, PARATYPES: CAS 68398.01–68398.10.

DIAGNOSIS. — Intermediate plates strongly mucronate, strongly arched; anterior margin with well-developed jugal sinus; apical area large, V-shaped.

DESCRIPTION. — Intermediate plates relatively thin, strongly mucronate with slightly convex posterolateral margins converging on apex; highly arched with narrow jugal area; jugal angle 95°–106°; side slopes flat, trapezoidal in outline; anterolateral margins often converging slightly anteriorly, curving narrowly into anterior margin; jugal sinus prominent, fairly deep; apical area large, 2.3 mm long, V-shaped, approximately one-third of total length at midline; shell material moderately thick medially, thinning laterally; surface smooth.

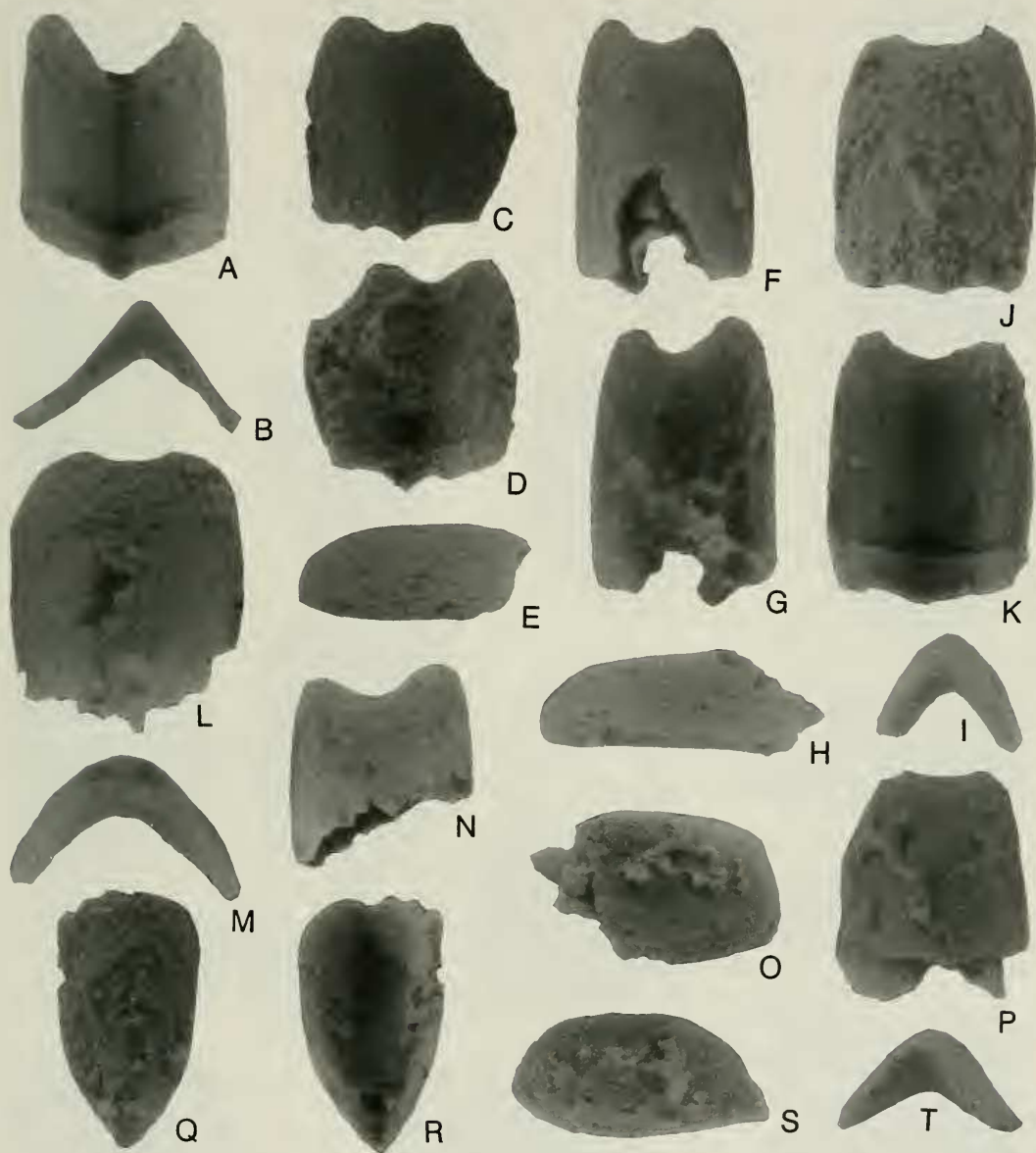


FIGURE 1. *Paleochiton siskiyouensis* sp. nov. A, B. Intermediate plate, ventral and posterior views (CAS 68396.01); C-E. Intermediate plate, dorsal, ventral, and left lateral views (CAS 68396.02); F-I. Intermediate plate, dorsal, ventral, left lateral, and anterior views (CAS 68396.03); J, K. Holotype, intermediate plate, dorsal and ventral views (CAS 68395); L, M. Intermediate plate, dorsal and anterior views (CAS 68396.04); N. Intermediate plate, dorsal view (CAS 68396.06); O, P. Intermediate plate with a second plate beneath it, right lateral and dorsal views (CAS 68396.08); Q-T. Tail plate, dorsal, ventral, left lateral, and anterior views (CAS 68396.05). All figures  $\times 5$ .

TABLE 1. Measurements (in mm) of *Paleochiton siskiyouensis* sp. nov.

CAS Collection No.	Length	Width	Height	Apical area
68395*	7.3	5.6	3.0	1.2
68396.01	7.3	5.7	3.7	1.2
68396.02	6.0	5.8	1.6	1.2
68396.03	—	4.8	3.0	—
68396.04	—	6.4	3.8	1.0
68396.05	6.9	4.1	3.4	—
68396.06	—	5.0	1.5†	—
68396.07	5.4	5.0	3.0†	1.2
68396.08	5.2	5.0	3.5	1.6
68396.09	5.9	4.9	2.6	—
68396.10	5.3	5.4	3.4	1.3
68396.11	7.0	5.8	3.0	1.2
68396.12	5.8†	5.0	2.5	1.1
68396.13	6.5†	6.0	3.1	—
68396.14	6.0†	5.5†	3.1	—
68396.15	4.8	5.6	2.6	1.4
68396.16	5.5	5.0	2.8	0.7
68396.17	6.3	3.4	2.4	0.8
68396.18	5.8	5.0	2.3	—

\* Holotype

† Estimated

Tail plate with well-developed jugal sinus; anterior lateral margins subparallel; posterolateral margins converging to posterior apex; not as strongly arched as intermediate plates; surface smooth. Head plate unknown.

MEASUREMENTS. — See Table 2.

DISCUSSION. — The genus *Thairoplax* was established by Cherns (1998b:946) for Silurian species from Gotland, Sweden, one of which had been previously placed in *Gotlandochiton* Bergenhayn, 1955. *Thairoplax* differs from the latter genus by its V-shaped apical area, more acute apex, and greater length:width ratio of intermediate plates. The primary difference between *T. merriami* and *T. pelta* Cherns, 1998b, the type species, is the larger, V-shaped apical area and converging anterodorsal margin in *T. merriami*. *Thairoplax* differs from *Chelodes* Davidson and King, 1874, by having thinner shell material, a sharp jugal flexure, and flat side slopes.

ETYMOLOGY. — Named for the late Charles W. Merriam, U. S. Geological Survey, who collected the specimens.

Family Mattheviidae Walcott, 1886

### Genus and species A

Figs. 2O–T

MATERIAL. — CAS 68399.01, CAS 68399.02.

DESCRIPTION. — Intermediate plates subquadrate, thick, broadly arched; little to no distinction between jugum and side slopes; anterior margin with well-developed jugal sinus; posterior margin straight to slightly mucronate; posterior lateral margins converging posteriorly; apical area very short; surface smooth. Head and tail plates unknown.

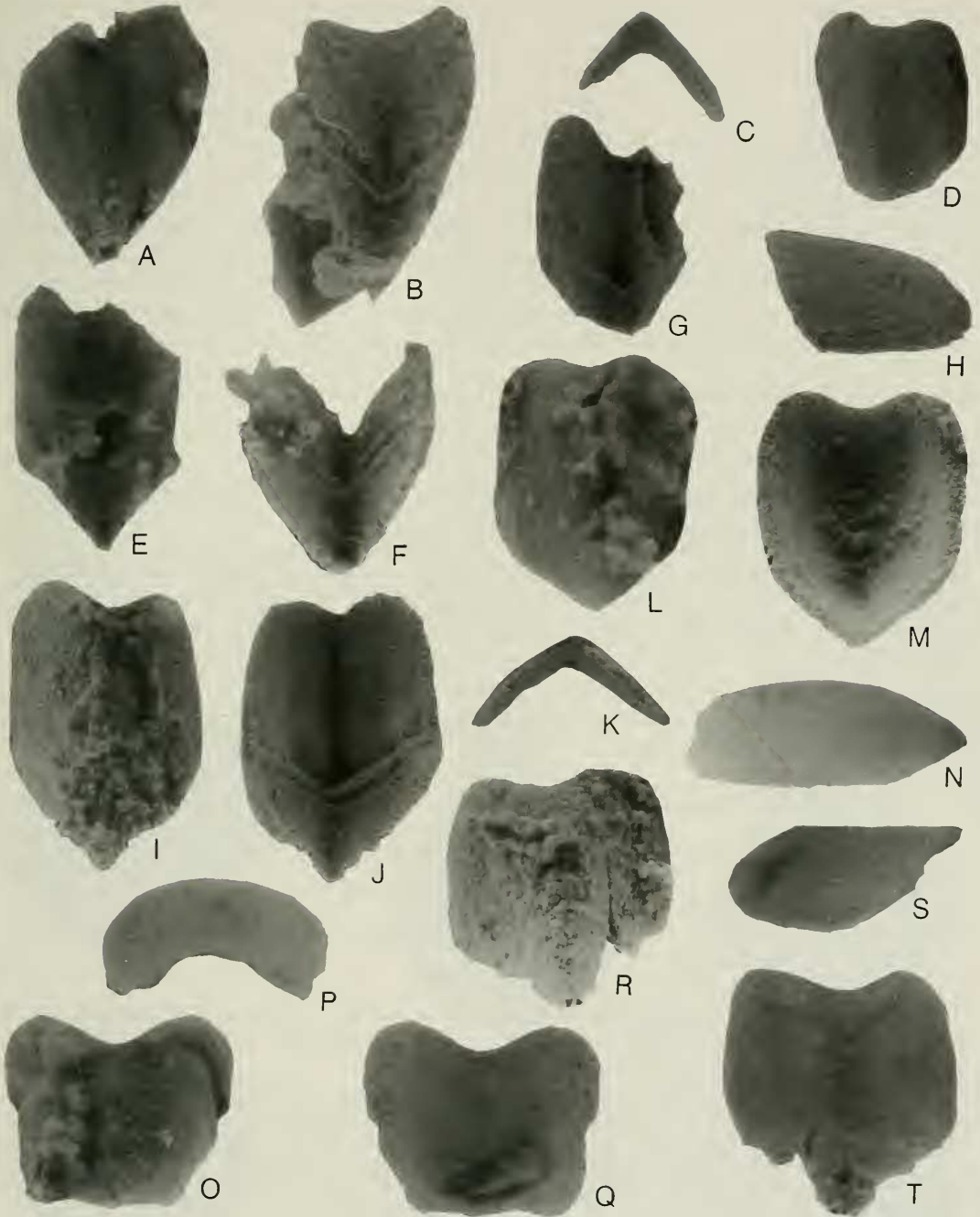


FIGURE 2. A–N. *Thairoplax merrami* sp. nov. A. Intermediate plate, dorsal view (CAS 68398.01); B. Intermediate plate, ventral view (CAS 68398.02); C, D. Intermediate plate, posterior and dorsal views (CAS 68398.03); E. Intermediate plate, ventral view (CAS 68398.04); F. Intermediate plate, ventral view (CAS 68398.05); G, H. Intermediate plate, ventral and right lateral views (CAS 68398.06); I–K. Holotype, intermediate plate, dorsal, ventral, and anterior views (CAS 68398.07); L–N. Intermediate plate, dorsal, ventral, and left lateral views (CAS 68398.07). O–T. Genus et sp. A. O–Q. Intermediate plate, dorsal, anterior, and ventral views (CAS 68399.01); R–T. Intermediate plate, dorsal, left lateral, and ventral views (CAS 68399.02). All figures  $\times 5$ .

TABLE 2. Measurements (in mm) of *Thairoplax merriami* sp. nov.

CAS Collection No.	Length	Width	Height	Apical area
68397*	8.5	5.8	2.8	2.7
68398.01	7.6	5.6	3.1	3.0
68398.02	8.8	5.2	2.4	2.9
68398.03	5.5	4.4	2.2	2.0
68398.04	7.7	5.0†	2.5	2.4
68398.05	6.6	6.0†	3.0†	2.6
68398.06	6.4	5.0†	3.2	1.3
68398.07	7.2	4.5	2.5	2.0
68398.08	7.4	6.2	3.0	—
68398.09	6.3	5.0	3.2	2.0
68398.10	6.9	4.8	3.4	—

\* Holotype

† Estimated

MEASUREMENTS. — Two plates range in length, 5.6–7.2 mm; in width, 6.9–6.8 mm; in height, 3.5–3.1 mm; in length of apical area, 0.5–0.6 mm.

DISCUSSION. — Two intermediate plates in the collection differ from both *Paleochiton siskiyouensis* and *Thairoplax merriami* in having a transversely thickened ridge on the ventral surface somewhat similar to that on *Alastega lira* Cherns, 1998b, from the Silurian of Sweden, but the latter taxon is more strongly arched and mucronate than the California specimens. The genus *Chelodes* Davidson and King, 1874, is similar in plate thickness and jugal sinus but is more mucronate, with a large apical area. *Kindbladochiton* Van Belle, 1975, and *Ivoechiton* Bergenhayn, 1955, do not have as great a shell thickness and are more strongly arched than the specimens described here, but they may represent a species of the latter genus.

Class Rostroconchia Pojeta, Runnegar, Morris, and Newell, 1972

Order Conocardioida Neumayr, 1891

Superfamily Eopteriacea Miller, 1889

Family Eopteriidae Miller, 1889

**Genus *Eusphairica* gen. nov.**TYPE SPECIES. — *Eusphairica distubula* sp. nov.

DIAGNOSIS. — Body subcircular in cross section; snout short; rostrum lacking; gape extending from just ventral of rostral opening to anterior end; posterior clefts present.

DESCRIPTION. — See *Eusphairica distubula* sp. nov.

DISCUSSION. — *Eusphairica* is monotypic. It differs from the Ordovician genera *Eopteria* Billings, 1865, and *Euchasuna* Billings, 1865, by its more tumid body shape, lack of a rudimentary rostrum, and gape not extending to the rostral opening. Both *Wanwanella* and *Wanwanoidea*, both by Kobayashi, 1933, as illustrated by Pojeta and Runnegar (1970), are narrower forms with less distant snouts than *Eusphairica*.

ETYMOLOGY. — Greek *eu* meaning primitive, good; plus *sphairica*, globular.

*Eusphairica distubula* sp. nov.

Fig. 3

TYPE MATERIAL. — HOLOTYPE: CAS68400.

DIAGNOSIS. — Same as genus.

DESCRIPTION. — Body small, subcircular in cross section: dorsal portion of posterior face extending posteriorly, slanted ventrally, curving sharply just below rostral opening and slanting anteriorly; rostrum not present; dorsal margin straight; beak slightly posterior to midlength; ventral margin of body straight, curving concavely into short snout; snout with key hole gape anteriorly; ventral gape narrow, extending posteriorly to just ventral of rostral opening; body with marginal denticles in gape; area around rostral opening smooth or with nonpreserved ribs; central portion of face with five to six fine ribs; four coarser radial ribs at juncture of posterior face and body; 13 or more finer radial ribs on body; anterior portion of snout may lack radial ribs; comarginal growth lines present ventrally on body and snout; internal features not observed.

MEASUREMENTS. — Length 7.0 mm; width 5.2 mm; height 5.2 mm; width of anterior end 1.7 mm; length of ventral gape 6.2 mm; diameter of rostral opening 0.8 mm.

DISCUSSION. — The subspheroidal shape of the body, the slightly angular projection of the extended posterior face, and the gape ending ventral to the rostral opening are diagnostic of *Eusphairica distubula*. *Eopteria struszi* Pojeta, Gilbert-Tomlinson, and Shergold, 1977, described from the Lower Ordovician of Australia, is somewhat similar to *Eusphairica distubula* but differs in being narrower, having coarser radial ribs, a rudimentary rostrum, and a gape extending into the rostrum. Johnson and Chatterton (1983) described nine new species representing five genera of rostroconchs from the Middle Silurian of the Northwest Territories, Canada. None of these beautifully preserved, silicified spec-

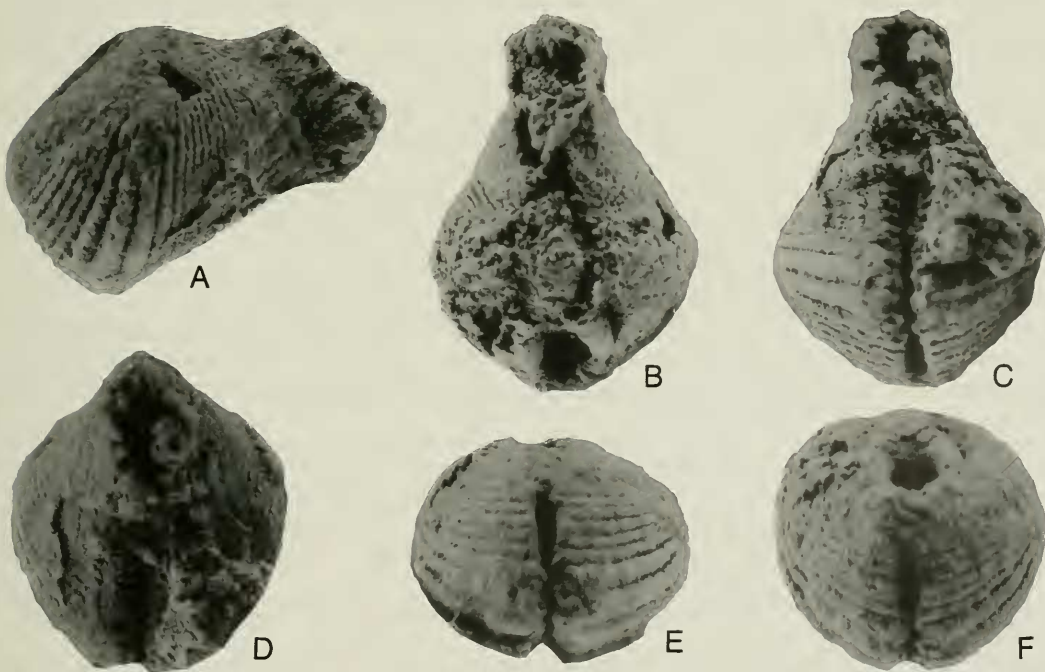


FIGURE 3. *Eusphairica distubula* gen. et sp. nov. (CAS 68400). A. Right lateral view; B. Dorsal view; C. Ventral view; D. Anterior view; E. Ventroposterior view; F. Posterior view. All figures  $\times 7$ .

imens have the characters of the posterior face, ventral gape, and arrangement of ribs as are present on *E. distubula*.

ETYMOLOGY. — Latin *dis* meaning without; plus *tubulus*, tube (rostrum).

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